OF-ASF 1.9.11
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4/14/2014

Draft Technical Memorandum

Orofino Asbestos Site

Vegetative Cover Performance Evaluation

April 14, 2014

This technical memorandum summarizes the results of an evaluation of the performance of the vegetative cover at the soil repository located at the First Baptist Church in Orofino, Idaho. The memorandum provides a summary of the field activities and observations and lab results of the soil characterization. A reconnaissance of the site was performed by Steve Hall and Mark Longtine on March 1, 2014, and sampling and other data gathering was performed by Jake Moersen and Mark Longtine on March 21, 2014.

FIELD ACTIVITIES AND OBSERVATIONS

Observations made during the March 1, 2014 reconnaissance were summarized in the email from Steve Hall to Greg Weigel on March 13, 2014. Key observations are reiterated below.

During the March 21, 2014 site visit, after making initial visual observations, we established a 9-point grid (3 x 3) across the area of the soil cover. At each grid point we dug a small test hole with a spoon or trowel to assess soil depth and characteristics at each grid point. The location of each grid points is visible as a small pile of soil with a blue sampling glove in Photo 1. Grid points are depicted schematically in Figure 1.

Field observations are summarized below and in Table 1:

- During the site reconnaissance performed by Steve Hall and Mark Longtine on March 1, 2014, saturated conditions appeared to exist over the entire soil cover area, with shallow ponding over much of the area (see Photos 2, 3, 4, and 5).
- During the March 21 site visit, there was no standing water on the soil cover area (see Photo 1), although the soil was found to be saturated at the surface and at depth locally. On March 21, soil moisture content varied by location, with slightly more than half of the area having saturated conditions below the immediate surface.
- Measured soil thickness was fairly consistent throughout the soil cap area, ranging from 8 to 10 inches.
- Across most of the soil cover area, the surface was covered by some amount of gravel up to 1.5 inches across. The amount of gravel on the surface was greater in the southern portion of the soil cover area. In places, up to approximately 60 percent or more of the surface area was

covered with gravel (see Photo 6). The presence of this clean gravel at the surface indicates that soil had been eroded (by runoff and/or wind), leaving the gravel lag behind.

- There was some vegetation on the soil surface locally, including small sprouts of grass, moss, and thick patches of clover-like plants up to several feet across (see Photos 7, 8, 9, and 10).
- Other than the concentration of gravel at the surface, the grain size distribution and soil color were generally consistent from the top to the bottom of each test hole. Grain size distribution is discussed further below.

Based on field observations, the soil was grouped into three general categories:

1) Gravel with silt/clay and sand, brown, saturated (grid points 1, 5, 6, 7, and 8). The amount of gravel ranged up to an estimated 50 percent. The gravel is angular and ranges up to 1.5 inches across. Due to the saturated conditions, the ability to perform field estimation of the grain size distribution (i.e., soil texture by feel method) was very limited. The distribution of grain sizes of the sand was difficult to assess in the field because of the large proportion of fines, both visually and by feel. See Photos 11, 12, and 13.
2) Sand with silt/clay and gravel, brown, moist (grid points 3, 4, and 9). The sand appeared to be poorly graded, with grain size predominantly fine and very fine. The amount of gravel was minor, except at the surface. See Photos 14 and 15.
3) Silt/clay and sand and gravel, brown, saturated (grid point 2). The soil was saturated at grid point 2 at least in part because it is located in a low area between the dry well and the asphalt parking lot. See Photo 16.

Based on field observations of soil grain size and moisture content, it was decided to take two composite soil samples for laboratory analysis (rather than the originally planned one sample), each intended to represent the conditions of the general categories of soil observed. The soil at grid point 2 was composited with soil at grid points 3, 4, and 9 since it more closely resembled that general soil type than the soil at the other grid points. To collect a composite soil sample, a vertically composited subsample was collected at each grid point. To do this, an even-thickness slice of the full soil column (from surface to the plastic membrane) was cut with a trowel from the test hole wall. The vertically composited subsamples from grid points 1, 5, 6, 7, and 8 were composited into one sample (sample 14031002, SCOBSL), and the subsamples from grid points 2, 3, 4, and 9 were composited into a second sample (sample 14031001, SCOASL). Each composite was homogenized by mixing manually. Sample 14031001 was homogenized by stirring in a large stainless steel bowl. Sample 14031002 was partially homogenized by kneading the soil in a 2-gallon re-sealable bag. This sample tended to form clumps and was not easily mixed by stirring in a bowl. The two composite soil samples were sent to Western Laboratories, Inc., located in Parma, Idaho, for analysis for grain size analysis (sieve and hydrometer) and agricultural parameters. Following soil sample collection, each test hole was backfilled with the unused excavated soil.

LABORATORY RESULTS

Western Laboratories, Inc. performed an "Official Texture" analysis on the soil, which consisted of a hydrometer analysis only; sieve analysis was not performed. To perform the hydrometer analysis, the composite soil sample was placed into a stainless steel bowl and mixed. Large gravel was manually removed and discarded. A one-pint size subsample of this material was taken from the bowl and oven-dried. The dried subsample was size-segregated into a "soil" fraction (passing through the 2 mm sieve) and a "non-soil" fraction (retained by the 2 mm sieve). The "non-soil" fraction was discarded. The "soil" fraction was analyzed for soil texture using a hydrometer, resulting in percentages of sand, silt, and clay. The "soil" fraction for each of the samples was classified as "Sandy Loam" based on the proportions of sand, silt, and clay measured in the "soil" fraction. Results are presented in Attachment B and below.

<u>Texture Analysis Results for "Soil" Fractions of Soil Samples</u>:

- Sample 14031001/SCOASL: Sand - 66.0 %, Silt - 34.0 %, Clay - 0.0 %
- Sample 14031002/SCOBSL: Sand - 60.0 %, Silt - 36.0 %, Clay - 4.0 %

Results of the agricultural parameters analysis are provided in Attachment B. Notable results of the agricultural analysis for both samples include low values for some nutrients and low values for percent organic matter.

OTHER CONSIDERATIONS

The original hydroseeding application of the soil cap was performed on October 5, 2012. This date is within the typical hydroseed application window, but near the end of the typical window (mid-October). Based on an email from Pat Heyneman, Environmental Quality Management, to Steve Hall on April 8, 2014, the property owner apparently did not water the hydroseeded soil for a number of days that followed the application. There was no precipitation at nearby Grangeville, Idaho, for the first seven days following application (http://www.wunderground.com/history/airport/KGIC/2012/10/1/MonthlyHistory.html?req_city=NA&req_state=NA&req_statename=NA). In order for hydroseeding to be successful, the application should be watered several times daily following application.

Pastor Hale Anderson informed Mark Longtine during the March 21, 2014 site visit that last summer he seeded the area between the drywell and the asphalt pavement because that area is typically wet and children often ride their bikes through the mud. He reportedly applied about ten pounds of seed. Some grass is growing in small patches in this area presently (see Photo 10).

Besides grass, the only other general kind of vegetation observed growing on the cover is a clover-like plant. No weeds were observed.

DISCUSSION AND CONCLUSIONS

Although some vegetation, including grass, is beginning to grow locally on the soil cover, the coverage is sparse. There appear to be multiple factors that are partially responsible for the lack of vegetation, discussed below.

Failure of Original Hydroseed Application

The original hydroseed application was reportedly not followed up with recommended daily watering. The hydroseed application may have provided enough moisture for the grass seed to germinate. However, without subsequent addition of water, the germinated seed would not survive.

Drainage

The soil present over about half of the soil cover area (including grid points 1, 5, 6, 7, 8) contains abundant gravel and fines. The gradation of sand grain size is not known. The overall grain size distribution of the soil in this area is generally well-graded, with particle size ranging from gravel to clay. In general, well-graded soils have less porosity and lower permeability than poorly-graded soils. A given quantity of water will saturate a larger volume of low-porosity soil than high-porosity soil. A well-graded soil will tend to drain more slowly than a poorly-graded soil. Soil porosity and permeability are particularly important in cases where there is a barrier preventing migration of water, such as the plastic membrane preventing downward migration of water at the Orofino soil cover. Complete saturation of available porosity is evidenced by ponding across the cover area observed on March 1, 2014, and full-thickness saturation observed in test holes over about half the cover on March 21, 2014.

Saturated conditions may limit plant growth. It is possible that the saturated conditions that exist at the soil cover for part of the year are at least partially responsible for lack of vegetation. Lack of plant growth in turn limits transpiration, which, if plants were present, would reduce the soil water content. It is possible that, if vegetation were to become established on the soil cap during a period of favorable conditions, that the plants would subsequently support evapotranspiration at rates adequate to limit saturated conditions in the future.

Nutrients and Organic Matter

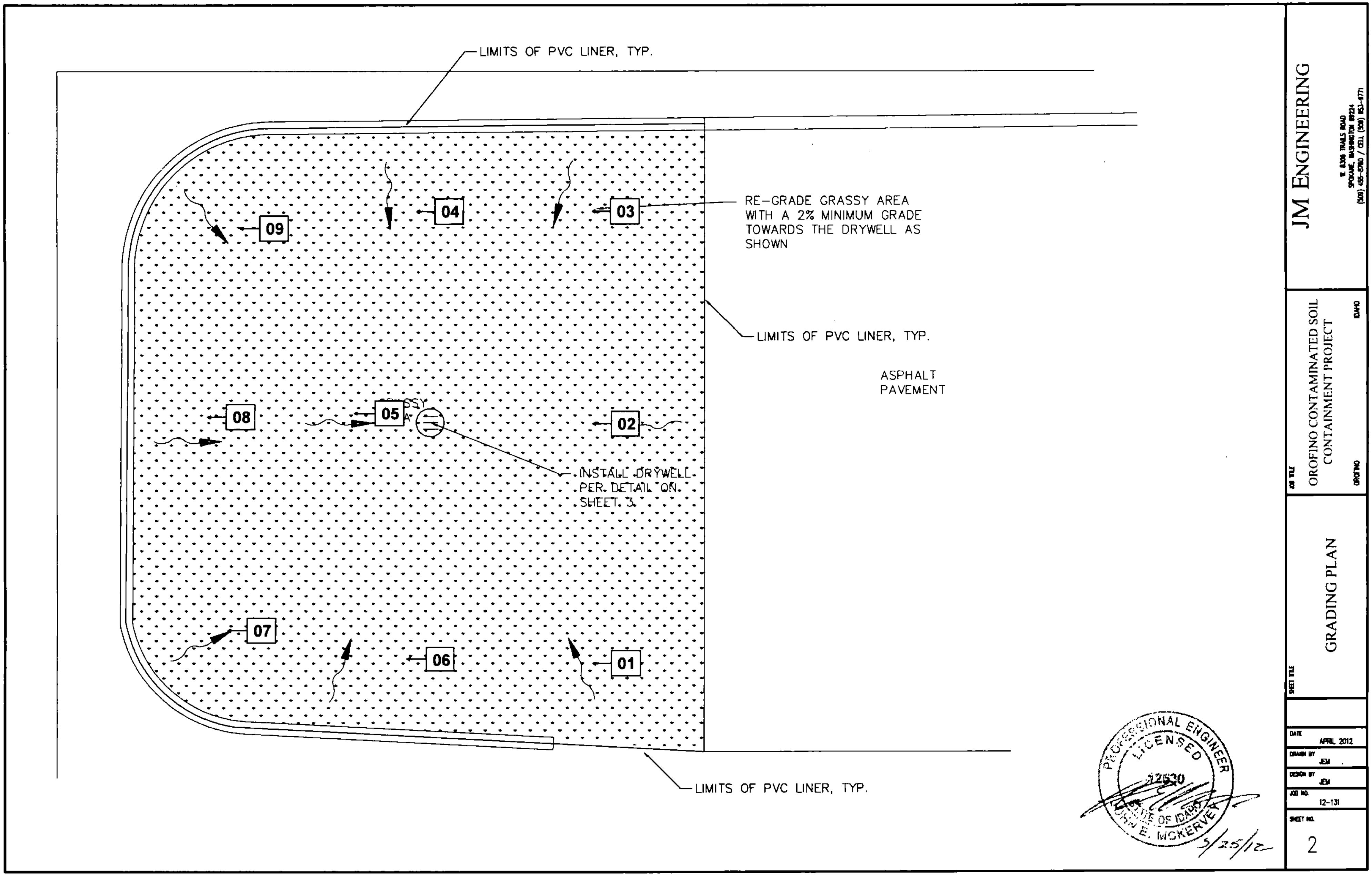
The soil is low in organic matter content and some plant nutrients. These low values likely contribute to the lack of vegetation on the cap. The hydroseed application provided nutrients and organic matter on the soil surface, presumably at levels adequate to establish vegetation. With failure of the hydroseeding to establish a grass cover, some of the hydroseeding-applied nutrients and organic matter were likely eroded away.

Gravel

Gravel presently covers much of the soil cover surface, particularly in the southern portion. Soil has been washed away from the gravel surfaces. The gravel acts to prevent contact of any new seed with soil and soil moisture.

RECOMMENDATIONS

1) Perform hydroseeding again this spring. Assure follow-up watering to support growth. Prior to application, work the soil to reduce the amount of gravel at the surface.
2) In addition to monitoring vegetative growth, monitor soil moisture conditions for saturation.
3) If hydroseeding is not successful, consider amending the existing soil with organic matter and/or nutrients.
4) If amending the existing soil with organic matter and/or nutrients is not successful, and excessive soil saturation persists, particularly in the southern portion of the soil cover, consider adding new soil or replacing existing soil to provide improved water-holding capacity and drainage.



LIMITS OF PVC LINER, TYP.
RE-GRADE GRASSY AREA WITH A 2% MINIMUM GRADE TOWARDS THE DRYWELL AS SHOWN
LIMITS OF PVC LINER, TYP.
ASPHALT PAVEMENT
INSTALL DRYWELL PER DETAIL ON SHEET 3.
LIMITS OF PVC LINER, TYP.
09
04
03
08
05
02
07
06
01
PROFESSIONAL ENGINEER
LICENSED
12530
STATE OF IDAHO
5/25/12
JM ENGINEERING
SPOKANE, WASHINGTON 99224
JOB TITLE
OROFINO CONTAMINATED SOIL CONTAINMENT PROJECT
OROFINO
IDAHO
SHEET TITLE
GRADING PLAN
DATE
APRIL 2012
DRAWN BY
JEM
DESIGN BY
JEM
JOB NO.
12-131
SHEET NO.
2

Table 1
Orofino Asbestos Site
First Baptist Church Soil Cover Soil Sample Summary
March 21, 2014

Grid Location	Composite Soil Sample ID	Soil Thickness (inches)	Moisture	Field Soil Description	Other Observations
02	SCOASL	8	Wet	Silt/clay with sand and gravel, brown, wet. Gravel is angular to 1 inch.	Located in low area between asphalt lot and dry well.
03		8	Moist	Sand with silt/clay and gravel, brown, moist. Clay and gravel minor. Sand mostly fine to very fine.	
04		8	Moist	Sand with silt/clay and gravel, brown, moist. Clay and gravel minor. Sand mostly fine to very fine.	
09		8	Moist	Sand with silt/clay and gravel, brown, moist. Clay and gravel minor. Sand mostly fine to very fine.	Piece of old torn black geotextile found buried at 4 inches depth.
01	SCOBSL	10	Wet	Gravel with silt/clay and sand, wet, brown. Gravel is angular to 1.5 inches.	
05		9	Wet	Gravel with silt/clay and sand, wet, brown. Gravel is angular to 1 inch.	
06		9	Wet	Gravel with silt/clay and sand, wet, brown. Gravel is angular to 1 inch.	
07		8	Wet	Gravel with silt/clay and sand, wet, brown. Gravel is angular to 1.5 inches.	
08		8	Wet	Gravel with silt/clay and sand, wet, brown. Gravel is angular to 1 inch.	

Photo 1

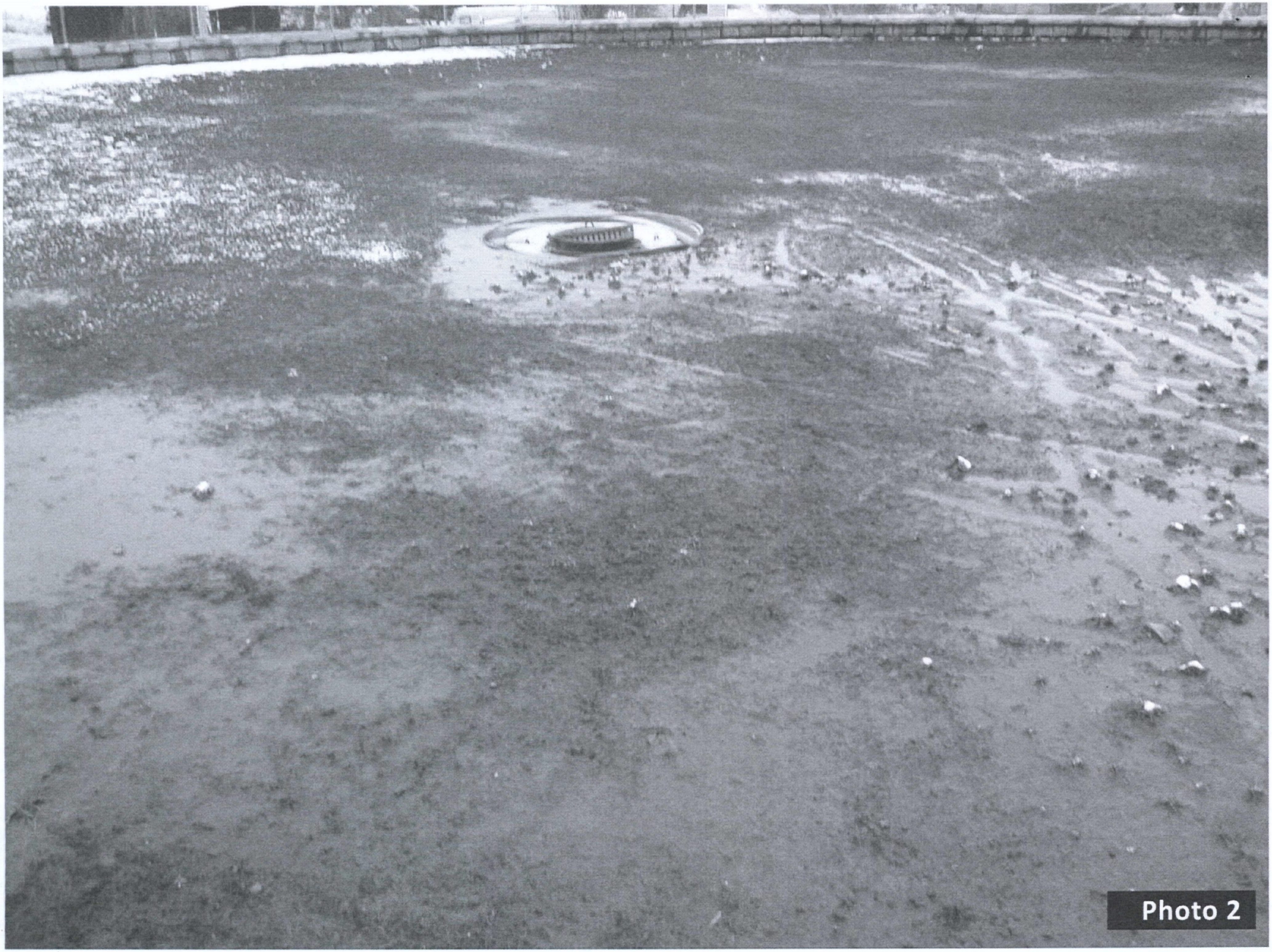


Photo 2


Photo 3


Photo 4

Photo 5

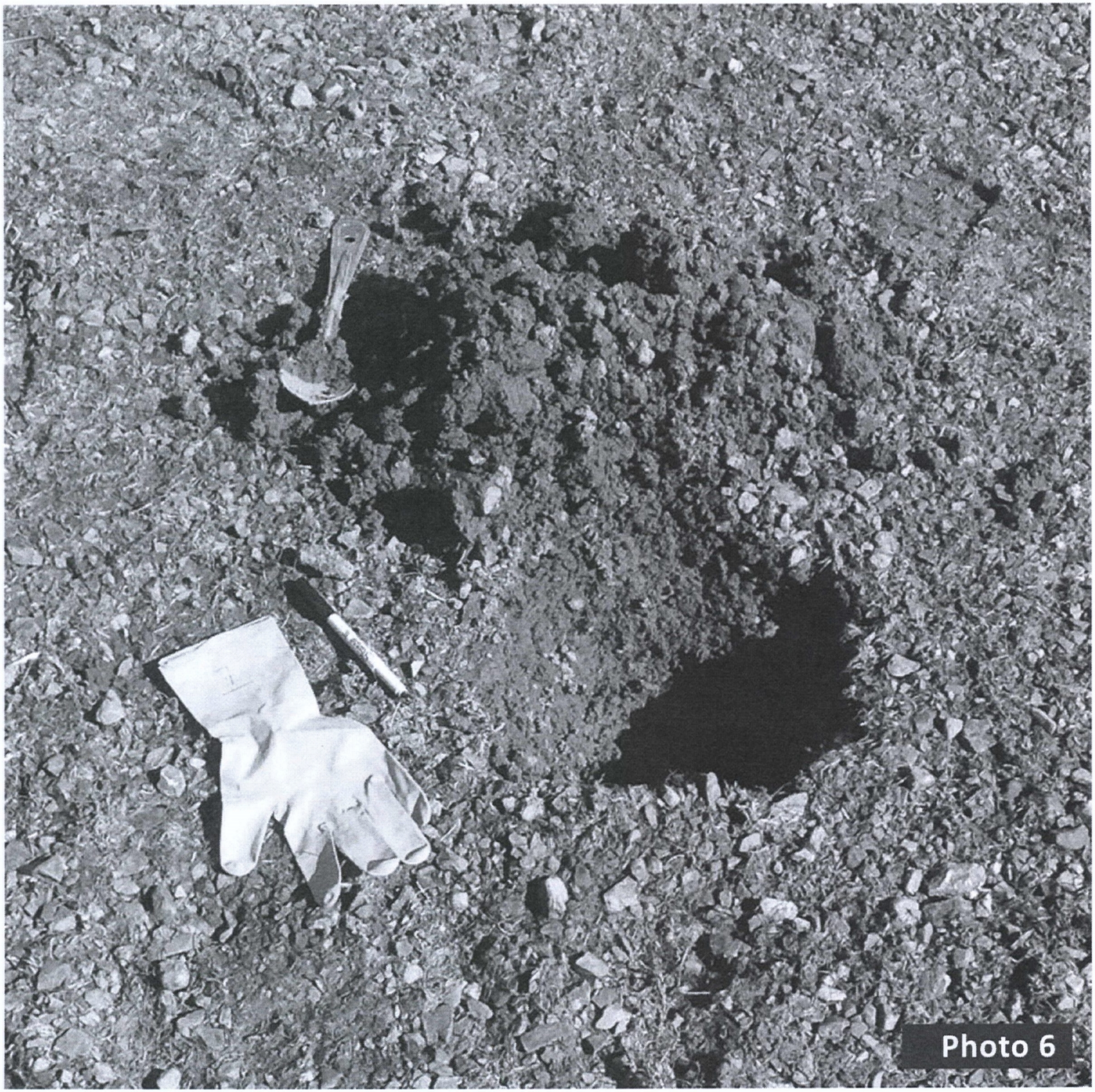


Photo 6

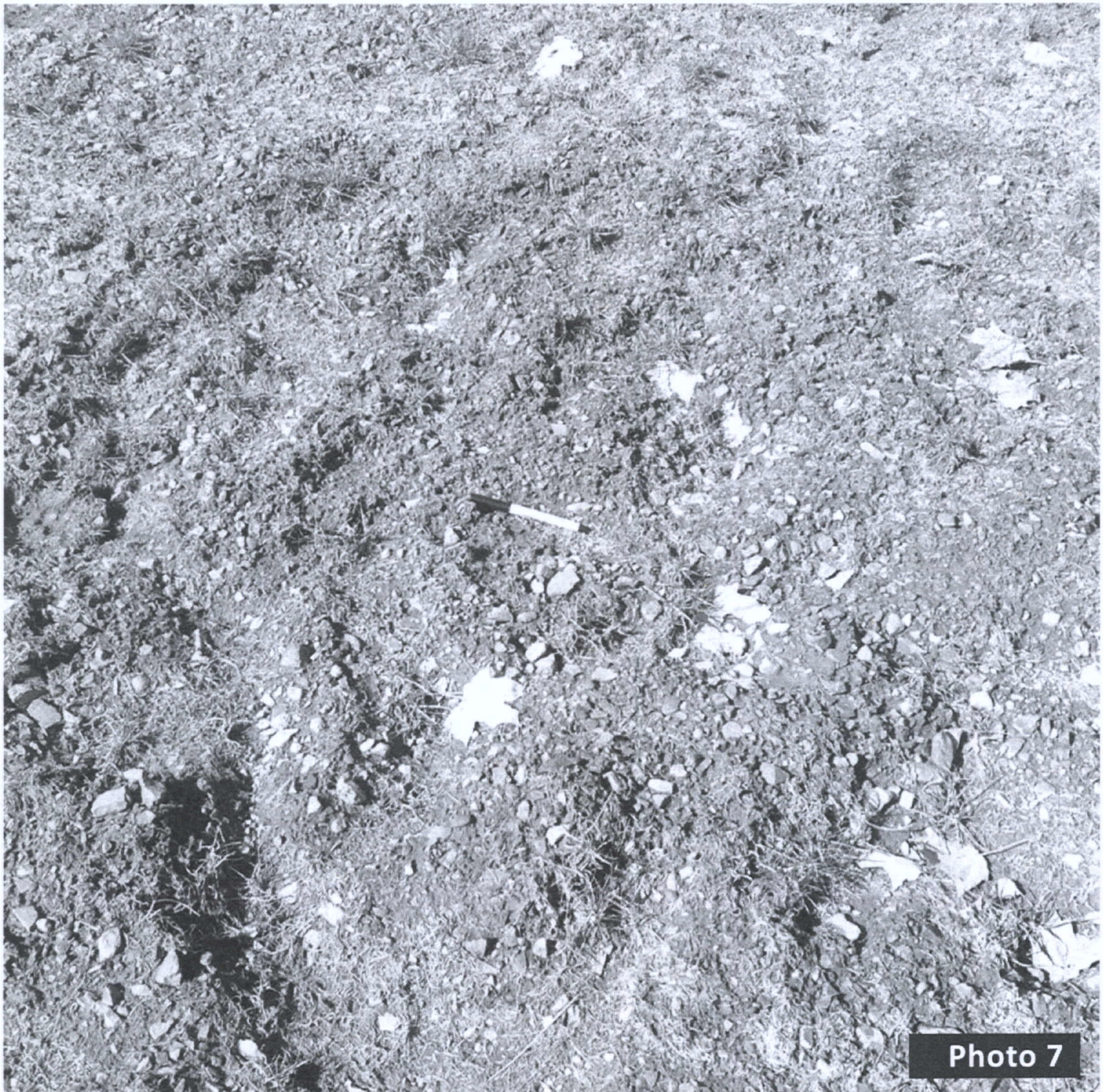


Photo 7

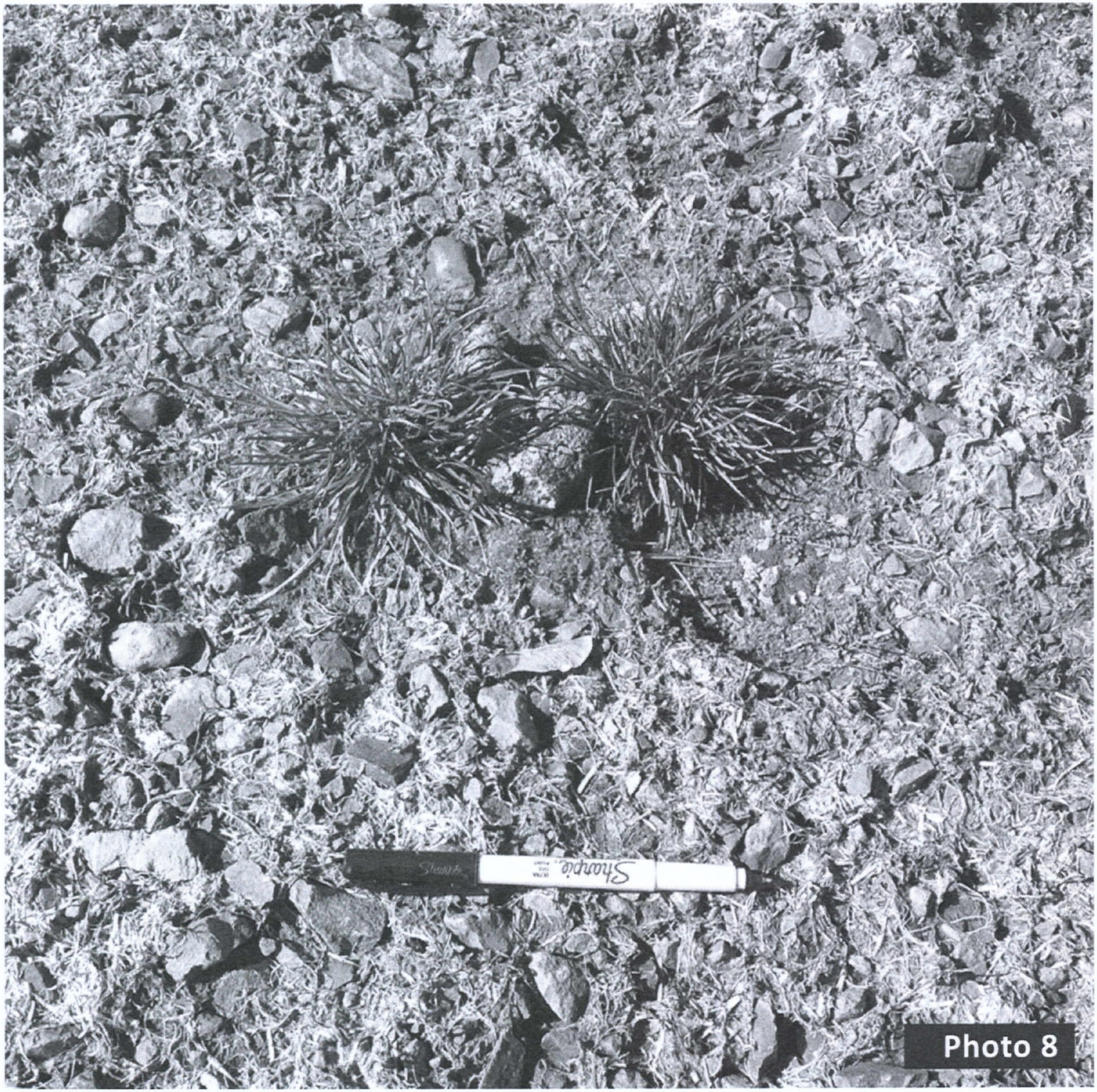


Photo 8

Photo 9

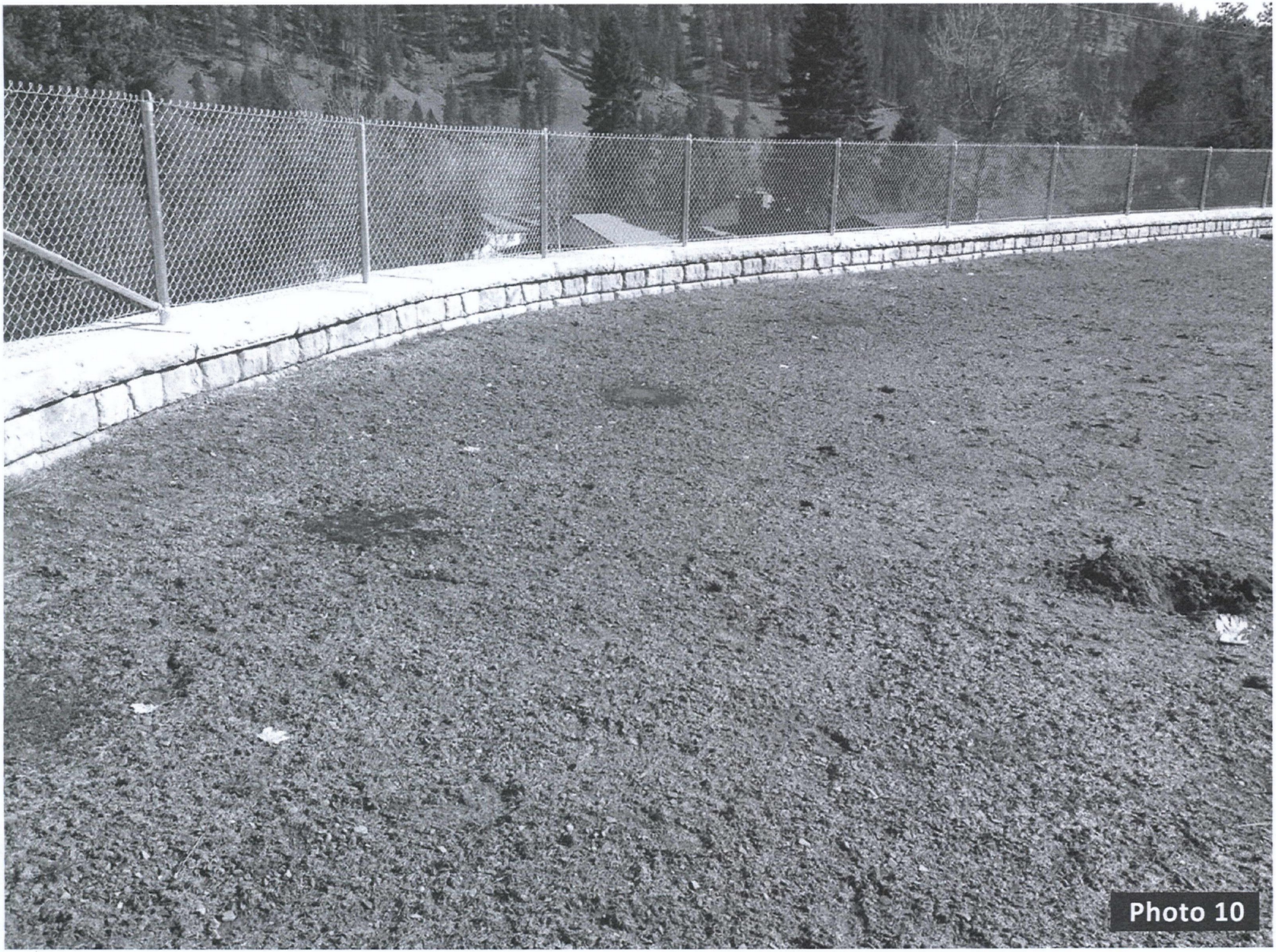


Photo 10

Photo 11


Photo 12

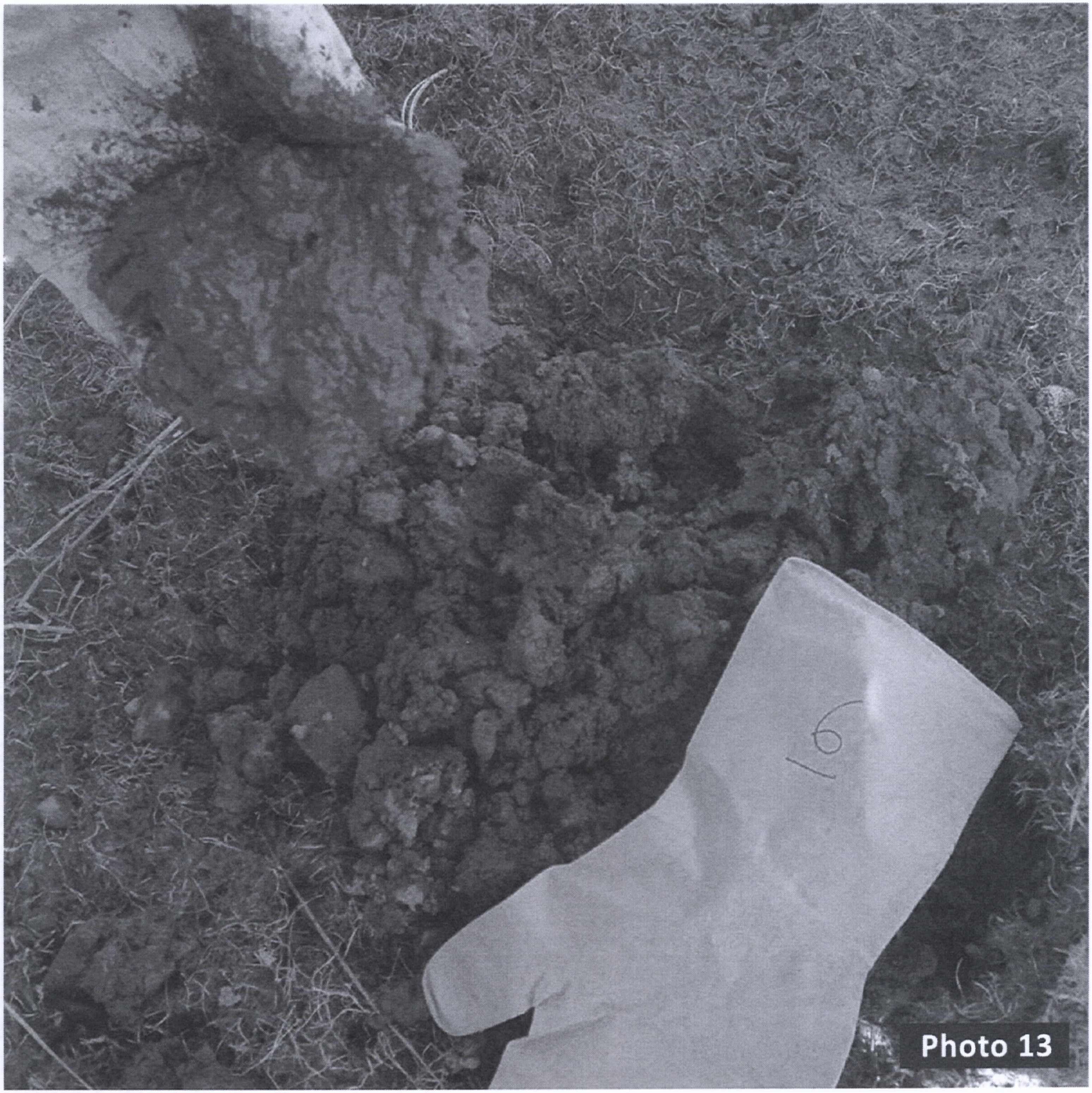


Photo 13

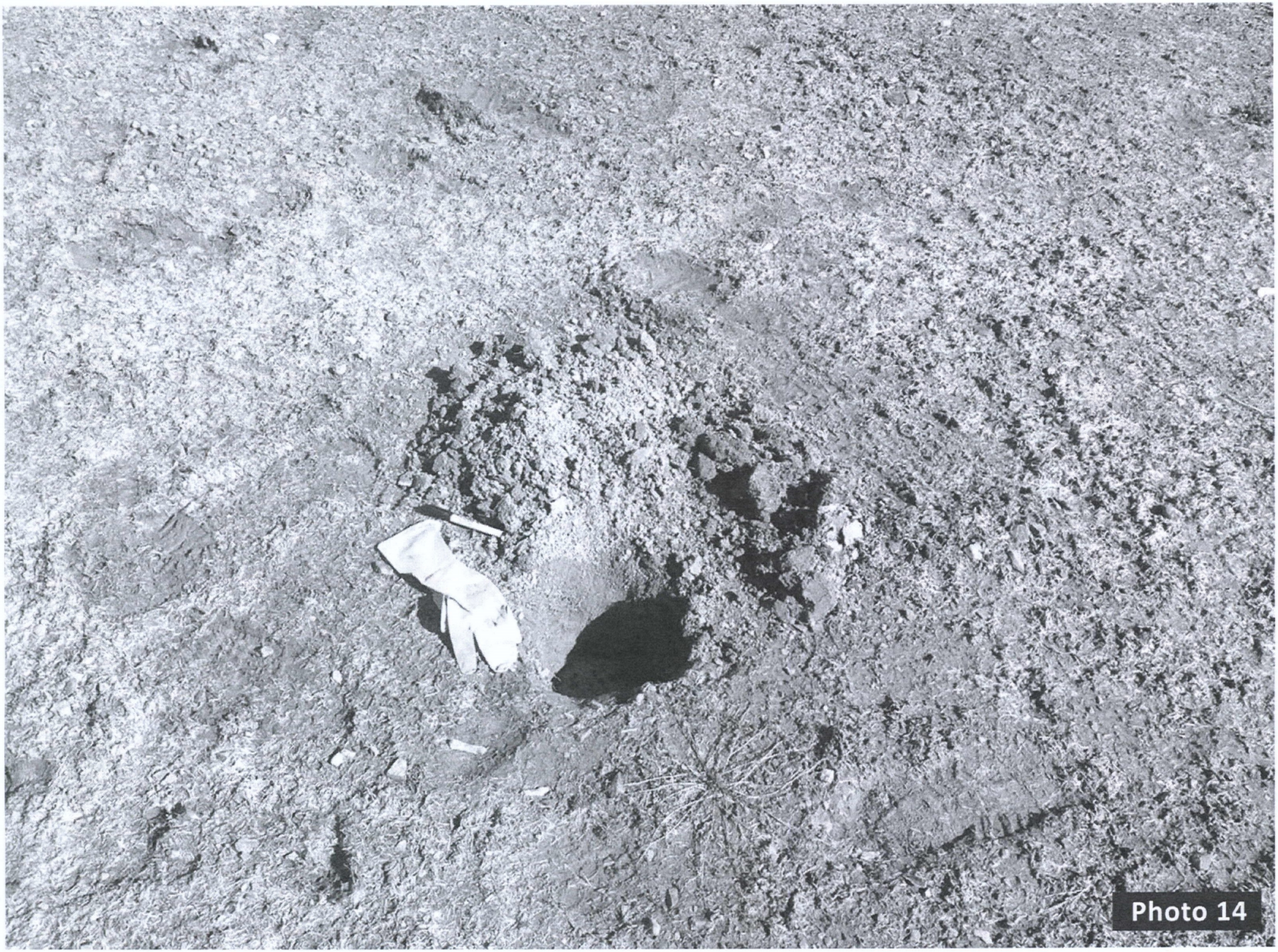


Photo 14

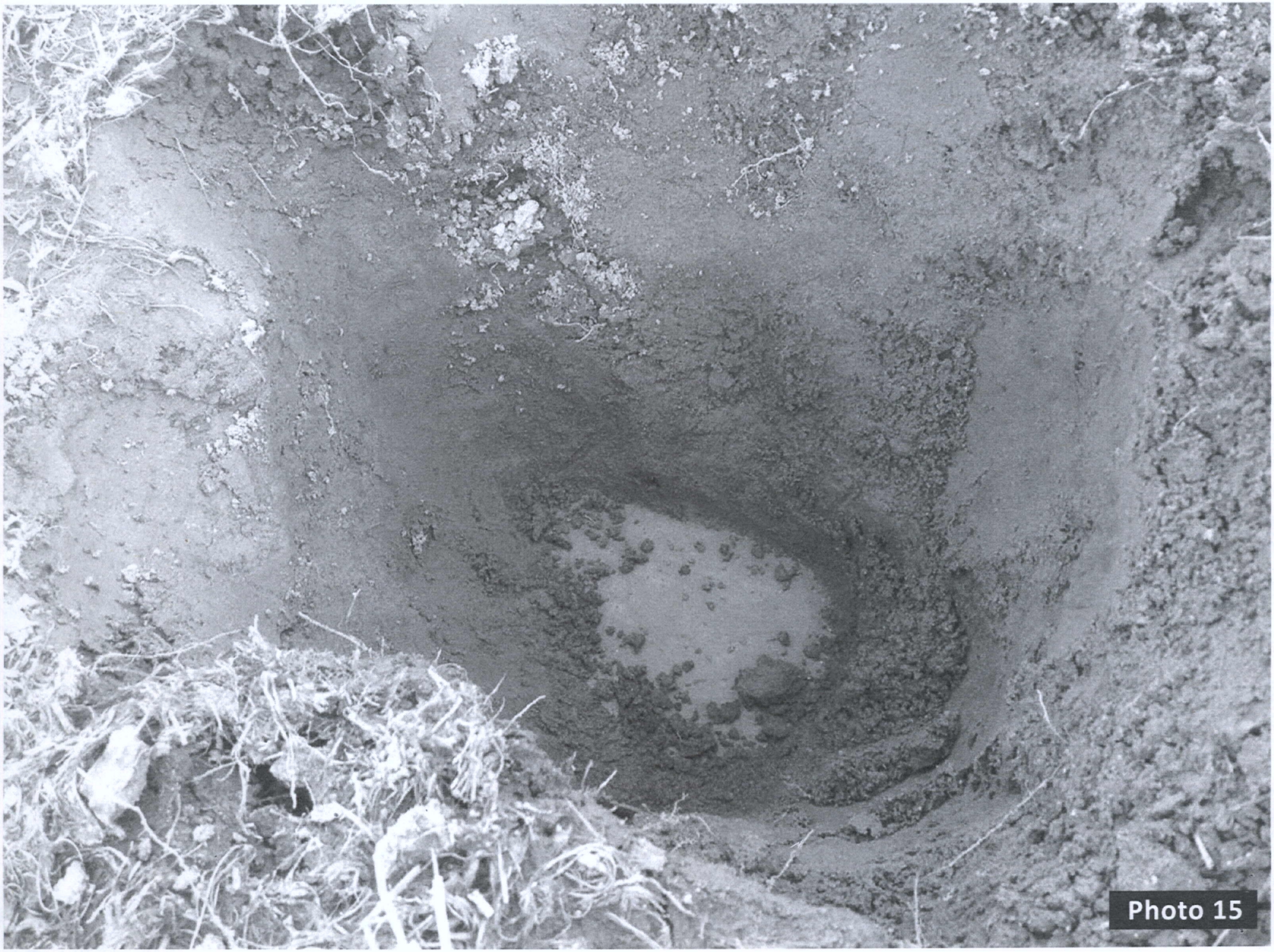


Photo 15

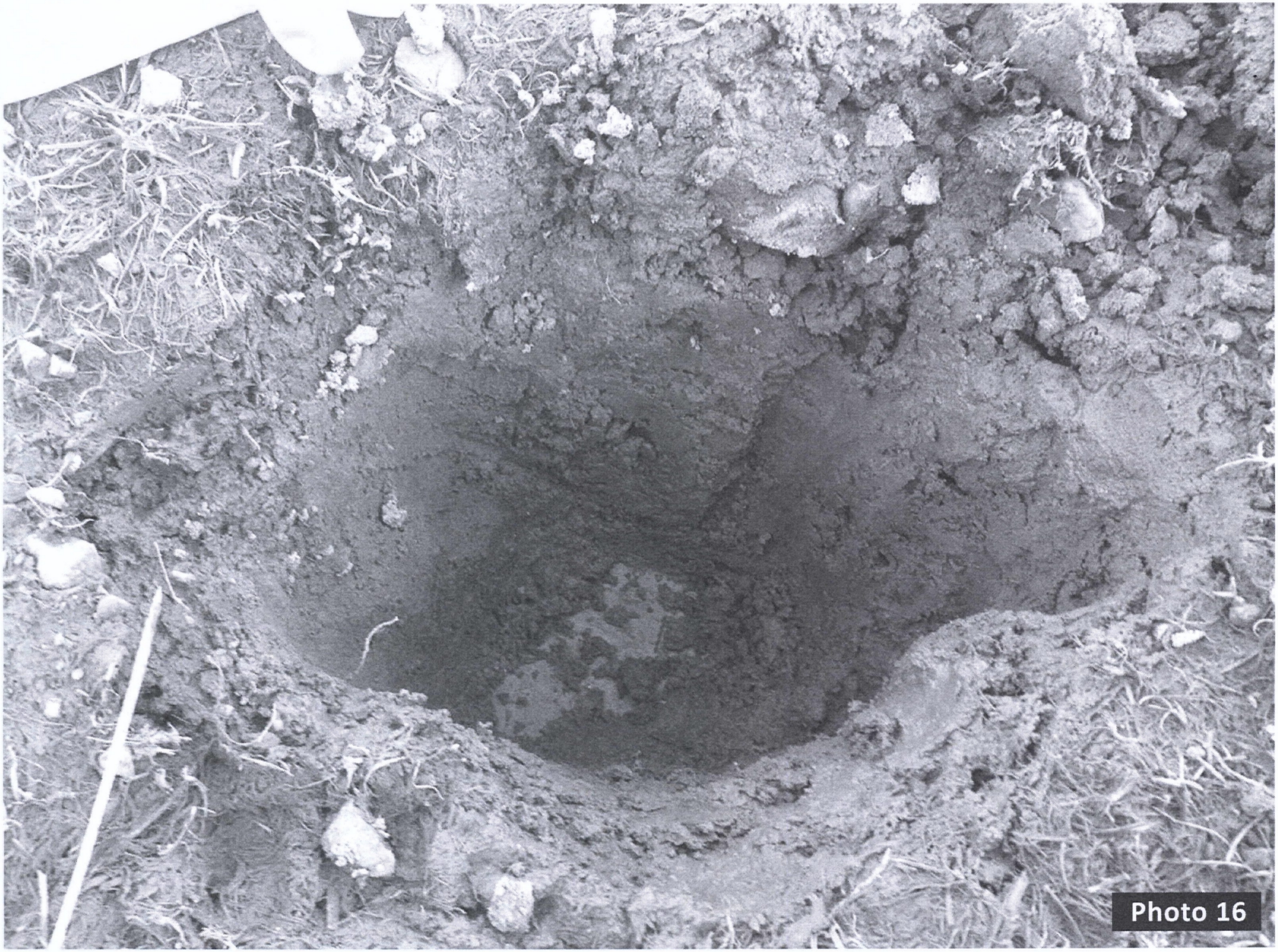


Photo 16

WESTERN LABORATORIES, INC.
211 Highway 95 • P.O. Box 1020
Parma, Idaho 83660
800-658-3858 • FAX 208-722-6550

Dealer #: 0-00

Date: 3/31/2014

Dealer: Ecology & Enviromental

OFFICIAL TEXTURE REPORT

Lab #	Grower	Field ID	% Sand	% Silt	% Clay	Textural Class
4324	Ecology &	14031001	66.0	34.0	0.0	Sandy Loam
4325	Ecology &	14031002	60.0	36.0	4.0	Sandy Loam

John P. Taberna, Soil Scientist

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http://www.westernlaboratories.com
Methods: www.westernlaboratories.com/methods.

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AGRICULTURAL SOIL REPORT

Dealer: 0-00 J Moersen
Reported: 3-28-2014
Test #: 1T
Grower: Ecology & Enviromental
Field ID: 14031001

Lab #:
4324

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	6.4	Slightly Acidic		Sulfur-ppm	8	Very Low	20 +
pH-SMP	6.6	Neutral Soil		Calcium-ppm	1505	Low	1,800 +
Soluble Salts	0.18	Normal	< 1.5	Magnesium-ppm	366	Adequate	250 +
% Lime	0	No lime		Sodium-ppm	53	OK	< 225
% Organic Matter	1.57	Low		Zinc-ppm	0.4	Very Low	1.0 - 3.0
Nitrates-ppm	10	Low	10 - 35	Copper-ppm	1.0	Adequate	0.8 - 2.5
Ammonium-ppm	4	Low	5 +	Manganese-ppm	5	Low	6 - 30
Phosphorus-ppm	23	Low	25 - 40	Iron-ppm	42	Adequate	25 +
Phos-ppm-Bray	53	Adequate	50 - 100	Boron-ppm	0.2	Very Low	0.7 - 1.5
Potassium-ppm	189	Low	300 +	TBS%	0		

Texture		Water Holding Capacity/foot		Bulk Density	

Cation Exchange Capacity - CEC	12	P Index	
Percent Base Saturation	94		

BASES	IDEAL	YOURS		NO3 ppm	NH4 ppm
Calcium-% of CEC	65-80	63	1 Ft	10	4
Magnesium-% of CEC	10-20	25	2 Ft		
Potassium-% of CEC	2-6	4	3 Ft		
Sodium-% of CEC (ESP)	< 5	1.9	Total N PPM		14
Hydrogen-% of CEC	< 15	6	Lbs N / Acre		42

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	4 :1	Low	Watch Ca
Ca:K pH >7	15:1	:1		
Ca:K pH <7	10:1	8 :1	OK	
Ca:P pH >7	100:1	:1		
Ca:P pH <7	40:1	65:1	High	Watch P
P:Zn	15:1	58 :1	High	Watch Zn
P:Mn	4:1	5:1	High	Watch Mn
P:Cu	25:1	23 :1	OK	
Zn:Cu	3:1	0 :1	OK	
Mn:Zn	3:1	13 :1	High	Watch Zn
Mn:Cu	7:1	5 :1	OK	
K:B	200:1	945 :1	High	Watch B
Mg:K	2:1	2 :1	Ok	

Fertilizer Suggestions in Pounds per Acre for the whole season		
Crop		
Yield Goal		
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash		
P.F. Sulfur		
Elemental Sulfur		
Gypsum		
Lime	1500	
Dolomite		
Magnesium		
Zinc		
Manganese		
Copper		
Boron		

Elemental Sulfur = Reclamation Sulfur P.F. Sulfur = Plant Food Sulfur

"Always practice the laws of Agronomy."
John P. Taberna, Soil Scientist

Split apply Nitrogen. Tissue and soil test in-season gives the best results

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Methods: www.westernlaboratories.com/methods.

PAP-Accredited NAPT 2012

AGRICULTURAL SOIL REPORT

Dealer: 0-00 J Moersen
Reported: 3-28-2014
Test #: 1T
Grower: Ecology & Enviromental
Field ID: 14031002

Lab #:
4325

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	6.7	Neutral Soil		Sulfur-ppm	10	Very Low	20 +
pH-SMP				Calcium-ppm	1685	Low	1,800 +
Soluble Salts	0.28	Normal	< 1.5	Magnesium-ppm	600	High	250 +
% Lime	0	No lime		Sodium-ppm	112	OK	< 225
% Organic Matter	1.25	Very Low		Zinc-ppm	0.4	Very Low	1.0 - 3.0
Nitrates-ppm	16	Adequate	10 - 35	Copper-ppm	2.8	High	0.8 - 2.5
Ammonium-ppm	2	Low	5 +	Manganese-ppm	4	Low	6 - 30
Phosphorus-ppm	15	Low	25 - 40	Iron-ppm	33	Adequate	25 +
Phos-ppm-Bray			50 - 100	Boron-ppm	0.3	Very Low	0.7 - 1.5
Potassium-ppm	343	Adequate	300 +	TBS%	0		

Texture		Water Holding Capacity/foot		Bulk Density	

Cation Exchange Capacity - CEC	15	P Index
Percent Base Saturation	99	

BASES	IDEAL	YOURS		NO3 ppm	NH4 ppm
Calcium-% of CEC	65-80	56	1 Ft	16	2
Magnesium-% of CEC	10-20	33	2 Ft		
Potassium-% of CEC	2-6	5.9	3 Ft		
Sodium-% of CEC (ESP)	< 5	3.2	Total N PPM		18
Hydrogen-% of CEC	< 15	1	Lbs N / Acre		54

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	3 :1	Low	Watch Ca
Ca:K pH >7	15:1	:1		
Ca:K pH <7	10:1	5 :1	OK	
Ca:P pH >7	100:1	:1		
Ca:P pH <7	40:1	112:1	High	Watch P
P:Zn	15:1	38 :1	High	Watch Zn
P:Mn	4:1	4:1	OK	
P:Cu	25:1	5 :1	OK	
Zn:Cu	3:1	0 :1	OK	
Mn:Zn	3:1	10 :1	High	Watch Zn
Mn:Cu	7:1	1 :1	OK	
K:B	200:1	1143 :1	High	Watch B
Mg:K	2:1	2 :1	Ok	

Fertilizer Suggestions in Pounds per Acre for the whole season		
Crop		
Yield Goal		
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash		
P.F. Sulfur		
Elemental Sulfur		
Gypsum		
Lime		
Dolomite		
Magnesium		
Zinc		
Manganese		
Copper		
Boron		

Elemental Sulfur = Reclamation Sulfur   P.F. Sulfur = Plant Food Sulfur

"Always practice the laws of Agronomy."
John P. Taberna, Soil Scientist

Split apply Nitrogen. Tissue and soil test in-season gives the best results